memorandum   ref.: SOHO-TOS/ESC-981110   Noordwijk, 10 November 1998

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subject : **SSU Patch 2A: Changes needed for upload procedure**

Mr. Possanzini from Officine Galileo prepared a 'patch of the patch' to fix the problem of the unexpected false events in SSU patch 2. The resulting patch is called SSU patch 2A. This patch was tested at ESTEC on the SSU S/W simulator and found to run without problems. When the original SSU patch 2 was run on the ESTEC simulator the many extra false events could be reproduced.

This memo gives the details how the TSTOL procedure a_ssu_patch2.prc, Version 3 of 1 Oct 1998 and the associated loads, SSU_PATCH2_1 .. SSU_PATCH2_5 have to be modified to upload SSU patch 2A.

The memo TOS-EMS/98-148/FA from F. Aidt and F. Possanzini from 29 Oct 1998 detailing the tests and the design of the 'patch of the patch' is attached.

Only loads SSU_PATCH2_1 and SSU_PATCH2_4 have to be modified. The contents of the other ones remain unchanged. I recommend to produce new loads named SSU_PATCH2A_1, SSU_PATCH2A_2, etc. and to delete the original ones from the system.

The contents part of load SSU_PATCH2_1 was as follows:

```
ABACU211 0X0007,0X7DEE,0X0002,0X7DF0,0X0002,0X7DF2,0X04E0;
ABACU211 0X0007,0X7DF4,0X7D86,0X7DF6,0XC085,0X7DF8,0X0605;
ABACU211 0X0007,0X7DFA,0XCA05,0X7DFC,0X7DE0,0X7DFE,0XC105;
ABACU211 0X0007,0X7E00,0X0934,0X7E02,0X0245,0X7E04,0X0007;
ABACU211 0X0007,0X7E06,0XA128,0X7E08,0X71B4,0X7E0A,0XA168;
ABACU211 0X0007,0X7E0C,0X71BE,0X7E0E,0XCA04,0X7E10,0X7DCC;
ABACU211 0X0007,0X7E12,0XCA05,0X7E14,0X7DD6,0X7E16,0XC142;
ABACU211 0X0007,0X7E18,0X04C4,0X7E1A,0X0202,0X7E1C,0X2B0E;
ABACU211 0X0007,0X7E1E,0X0452,0X7E20,0X7D88,0X7E22,0X7E24;
ABACU211 0X0007,0X7E24,0XC02D,0X7E26,0X0014,0X7E28,0XC1C0;
ABACU211 0X0007,0X7E2A,0X0607,0X7E2C,0X0A77,0X7E2E,0X0227;
ABACU211 0X0007,0X7E30,0X7620,0X7E32,0XC247,0X7E34,0XC057;
ABACU211 0X0007,0X7E36,0X0227,0X7E38,0X000E,0X7E3A,0XC097;
ABACU211 0X0007,0X7E3C,0X0227,0X7E3E,0X0062,0X7E40,0XC0D7;
ABACU211 0X0007,0X7E42,0X0227,0X7E44,0X000E,0X7E46,0XC117;
ABACU211 0X0007,0X7E48,0X8081,0X7E4A,0X1203,0X7E4C,0XC1C1;
ABACU211 0X0007,0X7E4E,0XC042,0X7E50,0XC087,0X7E52,0X80C2;
ABACU211 0X0007,0X7E54,0X1502,0X7E56,0XC042,0X7E58,0X100F;
ABACU211 0X0007,0X7E5A,0XC1C2,0X7E5C,0XC083,0X7E5E,0XC0C7;
```

```
ABACU211 0X0007,0X7E60,0X8103,0X7E62,0X1209,0X7E64,0XC1C3;
```

The italic ABACU211 has to be changed to:
```
ABACU211,0X0007,0X7E06,0X020A,0X7E08,0X7F96,0X7E0A,0X045A;
```

So the contents of load SSU_PATCH2A_1 becomes:

```
ABACU211 0X0007,0X7DEE,0X0002,0X7DF0,0X0002,0X7DF2,0X04E0;
ABACU211 0X0007,0X7DF4,0X7D86,0X7DF6,0XC085,0X7DF8,0X0605;
ABACU211 0X0007,0X7DFA,0XCA05,0X7DFC,0X7DE0,0X7DFE,0XC105;
ABACU211 0X0007,0X7E00,0X0934,0X7E02,0X0245,0X7E04,0X0007;
ABACU211,0X0007,0X7E06,0X020A,0X7E08,0X7F96,0X7E0A,0X045A;
ABACU211 0X0007,0X7E0C,0X71BE,0X7E0E,0XCA04,0X7E10,0X7DCC;
ABACU211 0X0007,0X7E12,0XCA05,0X7E14,0X7DD6,0X7E16,0XC142;
ABACU211 0X0007,0X7E18,0X04C4,0X7E1A,0X0202,0X7E1C,0X2B0E;
ABACU211 0X0007,0X7E1E,0X0452,0X7E20,0X7D88,0X7E22,0X7E24;
ABACU211 0X0007,0X7E24,0XC02D,0X7E26,0X0014,0X7E28,0XC1C0;
ABACU211 0X0007,0X7E2A,0X0607,0X7E2C,0X0A77,0X7E2E,0X0227;
ABACU211 0X0007,0X7E30,0X7620,0X7E32,0XC247,0X7E34,0XC057;
ABACU211 0X0007,0X7E36,0X0227,0X7E38,0X000E,0X7E3A,0XC097;
ABACU211 0X0007,0X7E3C,0X0227,0X7E3E,0X0062,0X7E40,0XC0D7;
ABACU211 0X0007,0X7E42,0X0227,0X7E44,0X000E,0X7E46,0XC117;
ABACU211 0X0007,0X7E48,0X8081,0X7E4A,0X1203,0X7E4C,0XC1C1;
ABACU211 0X0007,0X7E4E,0XC042,0X7E50,0XC087,0X7E52,0X80C2;
ABACU211 0X0007,0X7E54,0X1502,0X7E56,0XC042,0X7E58,0X100F;
ABACU211 0X0007,0X7E5A,0XC1C2,0X7E5C,0XC083,0X7E5E,0XC0C7;
ABACU211 0X0007,0X7E60,0X8103,0X7E62,0X1209,0X7E64,0XC1C3;
```

The contents of loads SSU_PATCH2A_2, SSU_PATCH2A_3 and SSU_PATCH2A_5 are identical to the contents of loads SSU_PATCH2_2, SSU_PATCH2_3 and SSU_PATCH2_5 respectively.

The contents of SSU_PATCH2_4 was:

```
ABACU211 0X0007,0X7F56,0XCAA0,0X7F58,0X2B9C,0X7F5A,0X7246;
ABACU211 0X0007,0X7F5C,0XC1AA,0X7F5E,0X7232,0X7F60,0X1609;
ABACU211 0X0007,0X7F62,0X8808,0X7F64,0X7202,0X7F66,0X1203;
ABACU211 0X0007,0X7F68,0X06A0,0X7F6A,0X2A68,0X7F6C,0X1011;
ABACU211 0X0007,0X7F6E,0XCA88,0X7F70,0X7282,0X7F72,0X100E;
ABACU211 0X0007,0X7F74,0XC1EA,0X7F76,0X7282,0X7F78,0X61C8;
ABACU211 0X0007,0X7F7A,0X0747,0X7F7C,0X8807,0X7F7E,0X7DF0;
ABACU211 0X0007,0X7F80,0X1205,0X7F82,0X0420,0X7F84,0X7EA0;
ABACU211 0X0007,0X7F86,0X072A,0X7F88,0X7DA8,0X7F8A,0X1002;
ABACU211 0X0007,0X7F8C,0XCA88,0X7F8E,0X7282,0X7F90,0XC2E0;
ABACU211 0X0007,0X7F92,0X78B8,0X7F94,0X045B,0X7F94,0X045B;
```

The italic ABACU211 has to be replaced by the following 5 ABACU211's:

```
ABACU211 0X0007,0X7F92,0X78B8,0X7F94,0X045B,0X7F96,0X04CA;
ABACU211 0X0007,0X7F98,0X802A,0X7F9A,0X71E8,0X7F9C,0X1302;
ABACU211 0X0007,0X7F9E,0X05CA,0X7FA0,0X10FB,0X7FA2,0XA12A;
ABACU211 0X0007,0X7FA4,0X71B4,0X7FA6,0XA16A,0X7FA8,0X71BE;
ABACU211 0X0007,0X7FAA,0X020A,0X7FAC,0X7E0E,0X7FAE,0X045A;
```

So the contents of SSU_PATCH2A_4 becomes:

```
ABACU211 0X0007,0X7F56,0XCAA0,0X7F58,0X2B9C,0X7F5A,0X7246;
ABACU211 0X0007,0X7F5C,0XC1AA,0X7F5E,0X7232,0X7F60,0X1609;
ABACU211 0X0007,0X7F62,0X8808,0X7F64,0X7202,0X7F66,0X1203;
ABACU211 0X0007,0X7F68,0X06A0,0X7F6A,0X2A68,0X7F6C,0X1011;
ABACU211 0X0007,0X7F6E,0XCA88,0X7F70,0X7282,0X7F72,0X100E;
ABACU211 0X0007,0X7F74,0XC1EA,0X7F76,0X7282,0X7F78,0X61C8;
ABACU211 0X0007,0X7F7A,0X0747,0X7F7C,0X8807,0X7F7E,0X7DF0;
ABACU211 0X0007,0X7F80,0X1205,0X7F82,0X0420,0X7F84,0X7EA0;
ABACU211 0X0007,0X7F86,0X072A,0X7F88,0X7DA8,0X7F8A,0X1002;
ABACU211 0X0007,0X7F8C,0XCA88,0X7F8E,0X7282,0X7F90,0XC2E0;
ABACU211 0X0007,0X7F92,0X78B8,0X7F94,0X045B,0X7F96,0X04CA;
ABACU211 0X0007,0X7F98,0X802A,0X7F9A,0X71E8,0X7F9C,0X1302;
ABACU211 0X0007,0X7F9E,0X05CA,0X7FA0,0X10FB,0X7FA2,0XA12A;
ABACU211 0X0007,0X7FA4,0X71B4,0X7FA6,0XA16A,0X7FA8,0X71BE;
ABACU211 0X0007,0X7FAA,0X020A,0X7FAC,0X7E0E,0X7FAE,0X045A;
```

The changes to a_ssu_patch2.prc follow directly from the changes in the loads.

The load names have to be changed in the header, lines 68-69.
The load name SSU_PATCH2_1 has to be changed to SSU_PATCH2A_1 on lines 367 and 371.
The load name SSU_PATCH2_2 has to be changed to SSU_PATCH2A_2 on lines 384 and 388.
The load name SSU_PATCH2_3 has to be changed to SSU_PATCH2A_3 on lines 399 and 403.
The load name SSU_PATCH2_3 has to be changed to SSU_PATCH2A_4 on lines 414 and 418.

Lines 558-560 change from:

```
WAIT UNTIL(AKMDRG13 = H'A128')
WAIT UNTIL(AKMDRG14 = H'71B4')
WAIT UNTIL(AKMDRG15 = H'A168')
```

to:

```
WAIT UNTIL(AKMDRG13 = H'020A')
WAIT UNTIL(AKMDRG14 = H'7F96')
WAIT UNTIL(AKMDRG15 = H'045A')
```

Lines 839-848 change from:

```
;#---------------------------------
;# ACU addresses:  A9DC - A9DF
;# SSU addresses:  7F8E - 7F95
;#---------------------------------

WAIT UNTIL(AKMDSADR - H'A9DC')
WAIT UNTIL(AKMDRG01 = H'7282')
WAIT UNTIL(AKMDRG02 - H'C2E0')
WAIT UNTIL(AKMDRG03 = H'78B8')
WAIT UNTIL(AKMDRG04 - H'045B')
```

to:

```
;#---------------------------------
;# ACU addresses:  A9DC - A9EB
;# SSU addresses:  7F8E - 7FAD
;#---------------------------------

WAIT UNTIL(AKMDSADR - H'A9DC')
WAIT UNTIL(AKMDRG01 = H'7282')
WAIT UNTIL(AKMDRG02 - H'C2E0')
WAIT UNTIL(AKMDRG03 = H'78B8')
WAIT UNTIL(AKMDRG04 - H'045B')
WAIT UNTIL(AKMDRG05 = H'04CA')
WAIT UNTIL(AKMDRG06 - H'802A')
WAIT UNTIL(AKMDRG07 = H'71E8')
WAIT UNTIL(AKMDRG08 - H'1302')
WAIT UNTIL(AKMDRG09 = H'05CA')
WAIT UNTIL(AKMDRG10 - H'10FB')
WAIT UNTIL(AKMDRG11 = H'A12A')
WAIT UNTIL(AKMDRG12 - H'71B4')
WAIT UNTIL(AKMDRG13 = H'A16A')
WAIT UNTIL(AKMDRG14 - H'71BE')
WAIT UNTIL(AKMDRG15 = H'020A')
WAIT UNTIL(AKMDRG16 - H'7E0E')

;#---------------------------------
;# ACU addresses:  A9EC - A9EC
;# SSU addresses:  7FAE - 7FAF
;#---------------------------------

WAIT UNTIL(AKMDSADR - H'A9EC')
WAIT UNTIL(AKMDRG01 = H'045A')
```

The load name SSU_PATCH2_5 has to be changed to SSU_PATCH2A_5 on line 1086.

That are all the changes needed to the SSU patch 2 procedure to update it to SSU patch 2A. I do not think it is necessary to produce a new SMILE for this. If you need it for other reasons,

e.g. formal configuration control, let me know and we will produce one.

Best Regards,

Ton van Overbeek

Dear Sirs,

When running the SOHO SSU s/w (reference SOHO-STR-FM-03-00-5.0) with the patch (reference SOHO-STR/024-96), in Mapping Mode with the Mv threshold 8.0, false events occurred.

As reported in MOM of SOHO Meeting at MMS-Toulouse (22/10/98), this is due to the fact that in the new routine SAVEMBP, R8 is used for accessing the window parameters rather than J where KEY(J)=R0, where R0 contains the IN of the current star.

This error will lead to false events in the case where the windows are positioned in the FOV in a different order w.r.t. the start identification numbers. This occurred several times during the Mapping Mode.

Therefore, an additional patch 2A was made for the SAVEMBP routine. In Appendix A is the source code of the patch 2A implemented by Officine Galileo and in Appendix B is the upload (SMILE) to be added in the tail of patch 2 or uploaded after patch 2.

The following tests were run to validate the correctness of the patch 2A.
- 1: Mapping Mode with threshold 8.0 with patch 2A
- 2: Mapping Mode with threshold 8.0 and a false pixel inserted after the first tracking star is obtained, using the s/w with patch 2A
- 3: As above, but with the original software without patch

In the first two cases, no false event are expected, while a false event is expected in the last case.

Furthermore, the tests as described in the memo WMS 96-181/FA are repeated with the following modifications.
- In the case with Mv 5.5 the original values of INDEX_MAX_DIFF of 2 is used
- In the case with Mv 5.5 runs with the false pixel is set to 2000 are made as well, as the previously used value of 600 is less than the MBP of about 708, and hence will be ignored in the case where it is 2 pixels away in Y and Z from the old barycentre.
- In the case with Mv=6.5 an energy of the false pixel of 2000 rather than 10000 is used
- The false pixel is reset to its original value (<=35)+ the background level rather than the background level, explaining a minor shift in the final coordinates

The following is expected.
- In the case with Mv 6.5 a false event due to Mv is expected for the original software in both the cases with the false pixel 1 and 2 pixels away from the old barycentre
- In the case with Mv 6.5 no false events should occur when using the software with patch 2A.
- In the case with Mv 5.5 when using the original software, a false event due to a change in the position should be generated for a false pixel with the energy 2000 and 1 or 2 pixels away in Y and Z from the barycentre. For the same cases with the energy of 600 rather than 2000 no false events should occur

- In the cases with Mv=5.5 no false events should be detected when using the software with patch 2A. In the case with a false pixel with the energy of 2000 2 pixels away in Y and Z from the old barycentre, however, it is expected to se the internal variable F_COUNTER to become 1 (i.e. no false events).

Results:

For the runs with Mapping Mode, the results were as follows.
- Run 1: The same stars were obtained as with the run with the original version (attachment LOG_NOPATCH from my note of 9 October 1998)
- Run 2: As above with the internal parameter F_COUNTER becoming 1 every cycle after the false pixel (i.e. no false events)
- Run 3:One false event and one star less with full accuracy (without patch)

Hence, patch 2A does not lead to a reduced number of stars found, and even with a false pixel remaining during the mapping, the list of stars found is not affected.

The runs from the memo WMS 96 - 181 / FA have been given in the following two tables. Note that the F_COUNTER and MAGN_INDEX are internal variables.

Table 1: Handling of SEU with and without SOHO SSU s/w patch 2A

STR s/w	False pixel (Yp,Zp)	Mv of star,energy of false pixel	Resulting star just after false pixel	Resulting star tracked (Y,Z,Mv)	False Event
FM-03 without patch False pixel 1 pixel away in Y and Z	(172,165)	6.5, 2000	(3059,3221, 5.4)	(3059,3221, 6.55)	YES (Mv), once after cycle with false pixel
FM-03 with patch 2A False pixel 1 pixel away in Y and Z	(172,165)	6.5, 2000	(3059,3221, 6.5)	(3059,3221, 6.5)	NO
FM-03 without patch False pixel 2 pixels away in Y and Z	(171,164)	6.5, 2000	(3059,3221, 5.55)	(3059,3221, 6.5)	YES (Mv), once after cycle with false pixel
FM-03 with patch 2A False pixel 2 pixels away in Y and Z	(171,164)	6.5, 2000	(3059,3221, 6.5)	(3059,3221, 6.5)	NO. F_COUNT ER 0->1->0

Table 1: Handling of SEU with and without SOHO SSU s/w patch 2A continued.

STR s/w	False pixel (Yp,Zp)	Mv of star,energy of false pixel	Resulting star just after false pixel	Resulting star tracked (Y,Z,Mv)	False Event
FM-03 without patch False pixel 1 pixel away in Y and Z	(172,165)	5.5, 600	(3107,3180, 5.15)	(3059,3221, 5.55)	NO, but two stars found and the correct one tracked
FM-03 with patch 2A False pixel 1 pixel away in Y and Z	(172,165)	5.5,600	(3059,3221, 5.55)	(3059,3221, 5.55)	NO MAGN_IN DEX 4a->42->4a (hex)
FM-03 without patch False pixel 2 pixels away in Y and Z	(171,164)	5.5, 600	(3215,3065, 5.5)	(3059,3221, 5.55)	NO false pixel ignored
FM-03 with patch 2A False pixel 2 pixels away in Y and Z	(171,164)	5.5, 600	(3059,3221, 5.5)	(3059,3221, 5.5)	NO false pixel ignored
FM-03 without patch False pixel 1 pixel away in Y and Z	(172,165)	5.5, 2000	(3059,3221, 4.60)	(3057,3223, 5.55)	YES once in cycle after false pixel
FM-03 with patch 2A False pixel 1 pixel away in Y and Z	(172,165)	5.5,2000	(3059,3221, 5.55)	(3059,3221, 5.55)	NO MAGN_IN DEX 4a->37->4a
FM-03 without patch False pixel 2 pixels away in Y and Z	(171,164)	5.5, 2000	(3059,3221, 4.75)	(3059,3221, 5.55)	YES once in cycle after false pixel
FM-03 with patch 2A False pixel 2 pixels away in Y and Z	(171,164)	5.5, 2000	(3059,3221, 5.5)	(3059,3221, 5.5)	NO F_COUNT ER 0->1->0

The following conclusions can be made.

- No false events are observed in Mapping Mode with patch 2A.
- The re-run of the original tests from WMS 96-181/FA produce the same results apart from the explained minor difference in the final coordinates.
- In the case with Mv=5.5 and the energy of the false pixel of 2000, false events are generated for the original software when the false pixel is 1 or 2 pixels away from the old barycentre.
- The software with patch 2A removes these false events.

Thus the software with patch 2A removes the false events which would be generated by using the original software.

No side effects are generated, since the results from the Mapping Mode are the same as those obtained when using the original software.

This is also the case when a false pixel with an energy of 2000 is introduced 2 pixels away from the old barycentre.

Hence the modification to the patch is considered to be validated.

Yours sincerely,

Finn Aidt, F. Possanzini

```
Patch A to patch 2 (seu) for SOHO SSU

* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*
* Program              SOHO-Star Tracker
*
* Program element      Patch 2A
*
* Author               Francesco Possanzini
*
* Date                 28 October 1998
*
* Version number       1
*
* Function             "find J such that KEY(J)=R0"
*
* Scope                SOHO-STR-PF-**-**-5.0
*                      SOHO-STR-FM-**-**-5.0
*
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
 -------------------------------------------------------------------
@ JUMP_OUT_ADDRESS
        LI R10 @PATCH_START_ADDRESS              020A 7F96
        B  *R10                                  045A
 -------------------------------------------------------------------
@ PATCH_START_ADDRESS
        CLR R10                                  04CA
LOOP:   C @KEY(R10) R0                           802A 71E8
        JEQ @FOUND                               1302
        INCT R10                                 05CA
        JMP @LOOP                                10FB
FOUND:  A @ZWP(R10) R4                           A12A 71B4
        A @YWP(R10) R5                           A16A 71BE
COME BACK:
        LI R10 @COMEBACK_ADDRESS                 020A 7E0E
        B *R10                                   045A
 -------------------------------------------------------------------

@JUMP_OUT_ADDRESS         @7E06
@COMEBACK_ADDRESS         @7E0E
@PATCH_START_ADDRESS      @7F96
@KEY                      @71E8
@ZWP                      @71B4
@YWP                      @71BE
NEXT FREE ADDRESS         @7FB0
```

```
Patch A to patch 2 (seu) for SOHO SSU

ADDRESS Data before Patch      Data for patch  Restore to unpatch
7E06H   A128                   020A            Yes
7E08H   71B4                   7F96            Yes
7E0AH   A168                   045A            Yes

7F96H   Free                   04CA            No
7F98H   Free                   802A            No
7F9AH   Free                   71E8            No
7F9CH   Free                   1302            No
7F9EH   Free                   05CA            No
7FA0H   Free                   10FB            No
7FA2H   Free                   A12A            No
7FA4H   Free                   71B4            No
7FA6H   Free                   A16A            No
7FA8H   Free                   71BE            No
7FAAH   Free                   020A            No
7FACH   Free                   7E0E            No
7FAEH   Free                   045A            No
```